COLUMBIA BASIN UPRIVER SALMON AND STEELHEAD STOCKS

STATUS INFORMATION RELATIVE TO CONSIDERATION

UNDER THE ENDANGERED SPECIES ACT

PREPARED BY THE IDAHO DEPARTMENT OF FISH AND GAME

MARCH, 1979

This information is provided in response to the request of Mr. Donald R. Johnson, Regional Director, National Marine Fisheries Service, for information on the status of Columbia Basin upriver salmon and steelhead stocks. We are submitting information only for stocks of fish that directly concern the State of Idaho.

1. IDENTIFICATION OF THE MOST SERIOUSLY DEPLETED STOCKS OF UPPER RIVER COLUMBIA BASIN SALMONIDS, THEIR GEOGRAPHICAL RANGES, AND TIMES OF MIGRATION AND SPAWNING.

STOCKS

Sockeye salmon *(Oncorhynchus nerka)*
Fall chinook salmon (*Oncorhynchus tshawytscha)*
Summer chinook salmon *(Oncorhynchus tshawytsha)*
Summer steelhead trout *(Salmo gairdneri)*

GEOGRAPHICAL RANGES

Sockeye

The present upper limit of their range in Idaho is believed to be Redfish Lake, at the headwaters of the Salmon River (Bjornn et al., 1968). Former runs into the Payette River, with primary spawning and rearing areas in the Payette Lakes and their tributaries, were terminated by a diversion dam and Black Canyon Dam on the lower Payette River in the early 1900's (Welsh et al., 1965).

Fall Chinook

Present distribution is confined to the main stem Snake River below Hells Canyon Dam (Idaho Department of Fish and Game. 1978). Spawning and rearing habitat is limited to the free-flowing portion of the Snake River from Asotin to Hells Canyon Dam (Mallet, 1974).

Summer Chinook

Significant native runs occur in the following Salmon River Tributaries: Rapid River, South Fork Salmon River, Secesh River, Johnson Creek, Pahsimeroi River, Big Creek. The main stem Salmon River from Challis to Stanley is also significant for spawning and rearing (Welsh et al., 1978; Mallet, 1974).

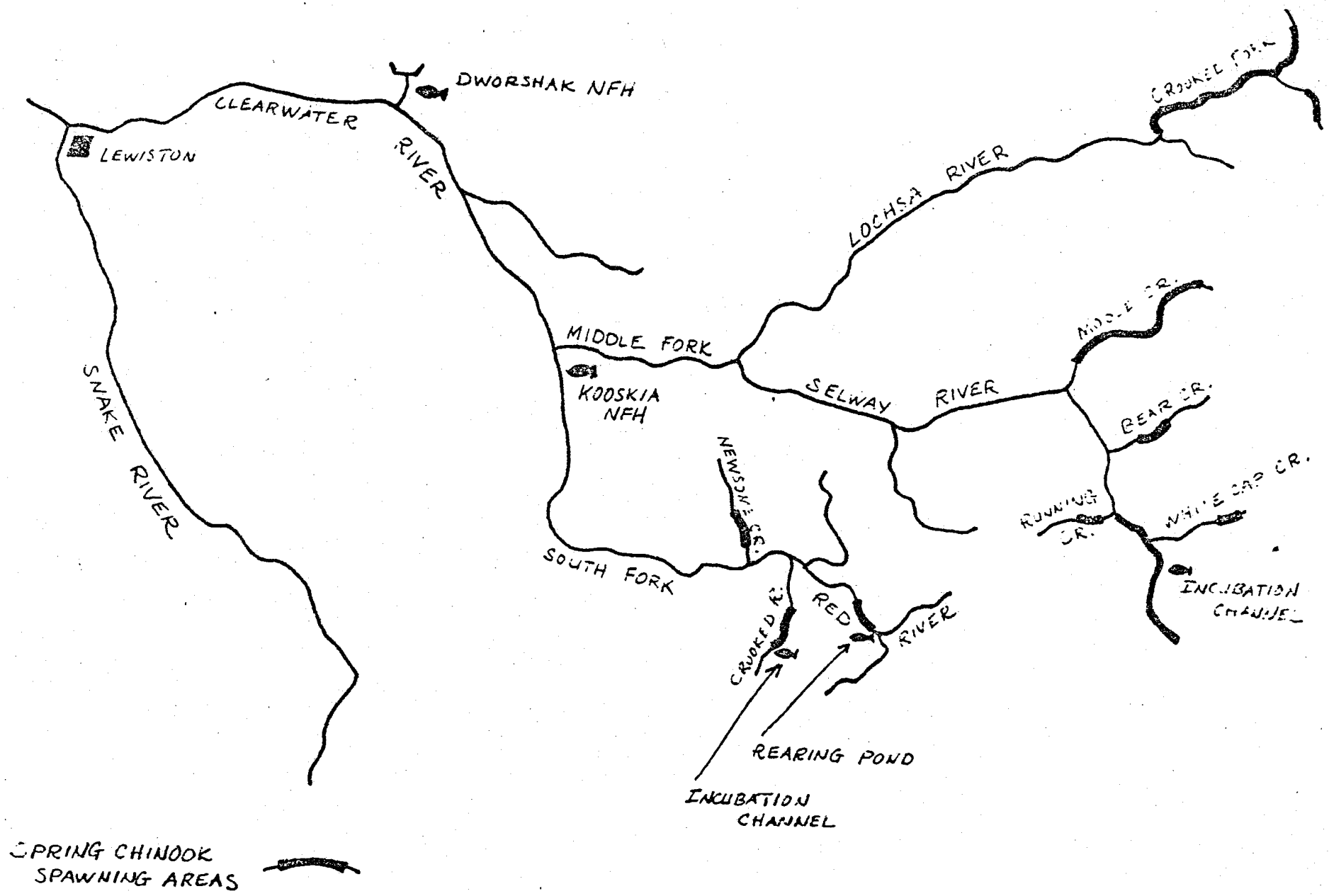
Spring Chinook

Reintroduction of this stock into the Clearwater River system has shown promising results despite adversities of the 1970's (Hoss, 1978).

The upper main stem of the Salmon River and numerous tributary systems contain native spring chinook. Spawning ground survey reports indicate the relative importance of some of the major spawning and rearing streams (Welsh, 1978). Figures 1 and 2 portray the extent of major spring and summer chinook spawning areas of the Salmon and Clearwater drainages (Mallet, 1974).

Summer Steelhead

The range of steelhead covers most of the Clearwater and Salmon River drainages and the Snake River up to Hells Canyon Dam (Mallet, 1974).



CLEARWATER RIVER DRAINAGE

FIGURE 1.

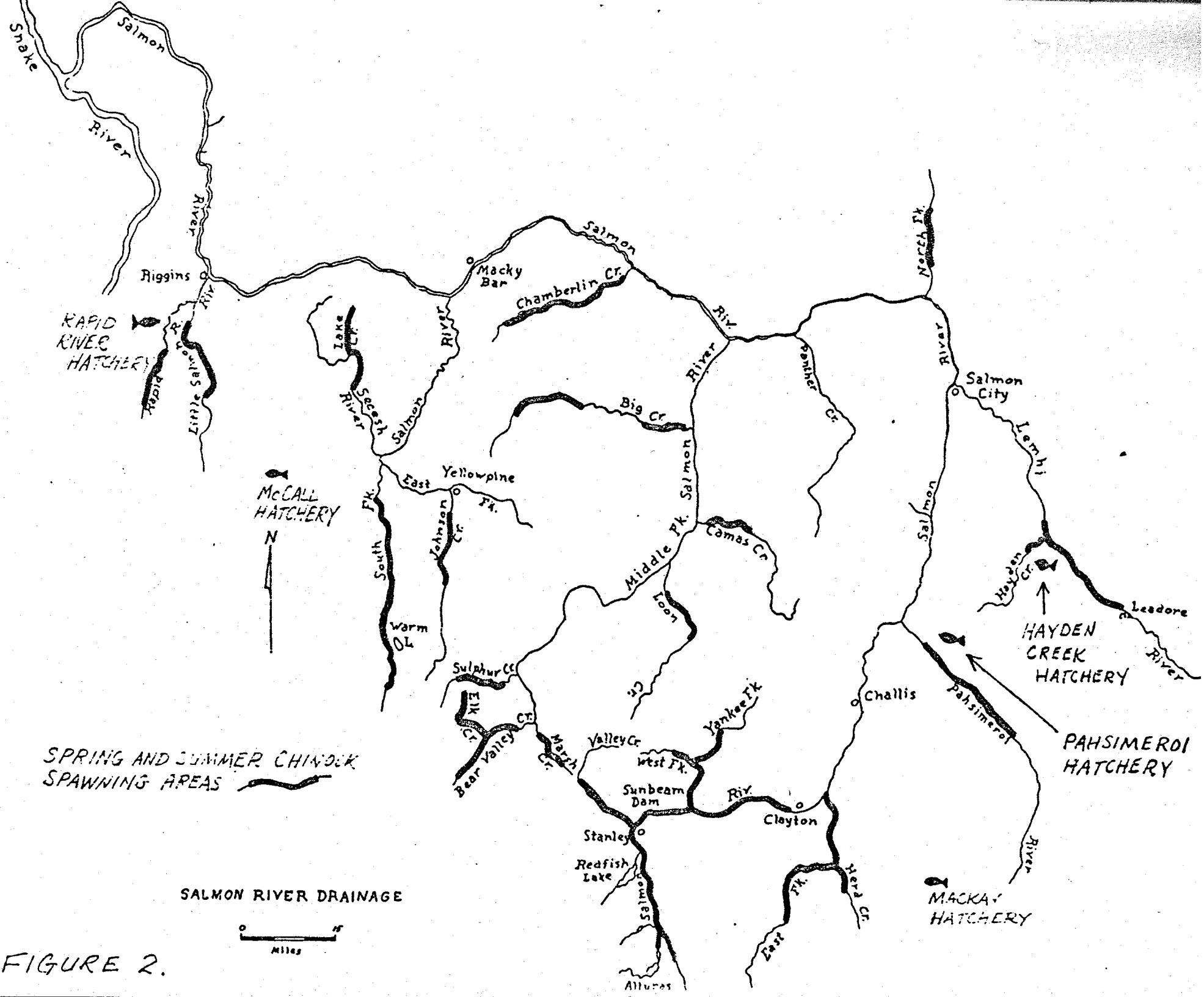

Snake River
Salmon River
Riggins
RAPID RIVER HATCHERY
Rapid R.
Little Salmon R.
McCALL HATCHERY
N
Lake Cr.
Secesh River
Salmon River
Macky Bar
Chamberlin Cr.
Salmon River
North Fk.
Big Cr.
Panther Cr.
Salmon River
Salmon City
Lemhi
East Fk.
Yellowpine
Johnson Cr.
South Fk.
Middle Fk. Salmon
Camas Cr.
Hayden Cr.
HAYDEN CREEK HATCHERY
Leadore
Warm Spring Cr.
Sulphur Cr.
Elk Cr.
Bear Valley Cr.
March Cr.
Valley Cr.
West Fk.
Yankee Fk.
Challis
Pahsimeroi
PAHSIMEROI HATCHERY
Sunbeam Dam
Salmon River
Clayton
Stanley
Redfish Lake
Salmon
East Fk.
Herd Cr.
MACKAY HATCHERY
Alturas
SPRING AND SUMMER CHINOOK SPAWNING AREAS
SALMON RIVER DRAINAGE
0
Miles

FIGURE 2.

MIGRATION AND SPAWNING TIMES

Sockeye

Adults enter the Columbia River from May through July, and the Snake River in June and July (U.S. Army Corps of Engineers, 1939-78). Sockeye arrive at Redfish Lake from late July through early September and spawn in October. Downstream migration occurs in April and May (Bjornn, 1968). Migration to the ocean probably requires 30 to 45 days.

Fall Chinook

Adults enter the Columbia River in August and September and the Snake River in September and October (Corps, 1939-78: Oregon Department of Fish and Wildlife and Washington Department of Fisheries, 1978).

Spawning occurs in October and November (Zimmer, 1950; Prittle, 1956). Downstream migration occurs in April and May (Graban, 1964).

Summer Chinook

Adults enter the Columbia River from May through July, and the Snake River in June and July (Corps, 1939-78;ODFW & WDF, 1978). Downstream migration is in April and May.

Spring Chinook

Adults enter the Columbia River in March, April and May and the Snake River in April and May (Corps, 1939-78; ODFW & WDF, 1978). Spawning is primarily in August and downstream migration of juveniles is in April and May.

Summer Steelhead

Adults enter the Columbia River from June through October and the Snake River from July through April (Corps, 1939-78; ODFW & WDF, 1978). Spawning is in April and May and downstream migration of juveniles is also in April and May.

2. OUANTIFICATION OF THE TRENDS OF DECLINE OF THE STOCKS

Sockeye

Evermann (1895) reported observations of “redfish” at Redfish Lake in 1964. Although he did not quantify the size of the run, the implication of his report was that the run numbered in the tens of thousands.

Sunbeam Dam blocked the Salmon River from 1913 to 1934, during which time the sockeye run was virtually prohibited access to Redfish Lake. Counts of the Redfish Lake sockeye run for the years 1954 through 1966 are reported by Bjornn (1968) and ranged from 11 to 4,361 fish. Accurate counts are not available for recent years; however, field checks indicate present run sizes may range from near zero to 100. It is believed that the yearly counts of sockeye at the lower Snake River dams are virtually all fish destined for Redfish Lake. The attrition rate from the upper dam to Redfish Lake is unknown, but is thought to be large.

Fall Chinook

Refer to: National Marine Fisheries Service, 1979. Summary of Workshop—Biological Basis for Listing Species or Other Taxa of Salmonids Pursuant to the Endangered Species Act of 1973. Pp. 74-76.

Summer Chinook

The runs into the Snake River and the Columbia River above its confluence with the Snake may have contained several million fish in the mid-1899’s. The Snake River run reached an all-time low of 7,200 fish in 1975 (Pacific Northwest Regional Commission, 1976).

The trend of abundance of summer chinook spawning redds in Idaho decreased alarmingly in the 1970's. Redds declined by a factor of three from 1972 to 1975 (Welsh et al., 1978). The longer term decline in the trend of redd counts is provided in Table 1.

The trend of production rates illustrates the health of the stock. Junge calculated that the summer chinook production rate (includes Columbia River stock) is presently less than 1.0 and that without improvement the stock will eventually become extinct (NMFS, 1979).

Spring Chinook

Junge computes that the upriver run production rate dropped from the pre-McNary Dam average of 5.5 to 1.3 during 1969-73. This is barely above survival level (NMFS, 1979).

The runs of 1974, 1975, and 1976 were described as disastrous by the Oregon Department of Fish and Wildlife and Washington Department of Fisheries (ODFW & WDF, 1978). Comparable counts of redds in the Salmon River system of Idaho were alarmingly low in 1974, 1976 and 1977 (Table 2).

Summer Steelhead

Upriver runs of 1974, 1975, and 1976 established records for low numbers (ODFW & WDF, 1978).

Junge reported the present production rate at less than 1.0 during 1969-73 NMFW, 1979). Wild stocks of Idaho steelhead are in especially critical condition. Creel checks on the Clearwater River from January 20 to March 2, 1979, showed that only 7.3 percent of the catch was of non-hatchery origin (unpublished data of IDF&G). Escapement of naturally-produced steelhead can be estimated by the following formula:

TABLE 1

SUMMER CHINOOK REDD COUNTS

Year	Lower Salmon River	Lower Valley Creek	Lower East Fork	Loon Creek	S. Fork Salmon River	Johnson Creek	Secesh River Lake Cr.	Lower Big Creek	TOTALS	FIVE-YEAR AVERAGE
1978	349	219	NC	29	251	113	91	--	1,052	
1977	94	63	136	62	226	81	27	--	689	
1976	44	43	39	31	241	68	17	--	483	681
1975	45	80	38	32	238	69	10	--	512	
1974	200	45	49	34	218	107	21	--	671	
1973	224	77	138	78	586	271	74	--	1,448	
1972	412	39	161	150	577	220	87	NC	1,646	
1971	220	147	149	79	421	183	80	52	1,331	1,400
1970	150	41	123	43	527	130	63	23	1,100	
1969	120	22	138	110	636	273	104	72	1,475	
1968	223	63	235	135	515	127	58	33	1,389	
1967	265	79	234	96	902	286	140	94	2,196	
1966	390	184	216	49	980	110	140	51	2,120	2,028
1965	201	57	131	166	656	116	134	83	1,544	
1964	415	71	306	361	1,124	310	181	121	2,889	
1963	195	50	265	261	1,057	266	163	220	2,477	
1962	467	115	195	157	1,589	295	292	360	3,470	
1961	356	162	198*	131	1,058	207	198	160	2,470	3,307
1960	818	141	303*	334	2,306	517	524	352	5,295	
1959	336	70	192*	123	1,305	294	285	217	2,822	
1958	362	47	--	--	1,236	269	478	338		
1957	2,406	331	--	--	2,812	349	344	535		

*Adjusted for boundary changed instituted in 1962.

TABLE 2

SPRING CHINOOK REDD COUNTS

Year	Alturas Lake Creek	Bear Valley Creek	Elk Creek	Lemhi River	Marsh Creek Drainage	Sulphur Creek	Upper East Fork
1978	303	184	208	796	270	64	841
1977	85	129	86	474	98	5	168
1976	16	76	61	241	48	14	75
1975	60	215	169	366	201	50	348
1974	42	130	108	215	210	30	346
1973	153	387	369	485	518	78	665
1972	143	221	212	507	312	71	448
1971	50	108	173	407	281	58	370
1970	68	334	302	371	456	93	468
1969	41	356	349	360	235	138	174
1968	110	574	483	589	466	142	622
1967	74	445	420	804	650	134	614
1966	119	534	525	819	406	142	511
1965	101	301	203	454	404	43	138
1964	80	576	425	1,151	709	97	405
1963	86	460	654	364	372	332	646
1962	138	484	426	1,455	345	169	334
1961	30	675	384	1,871	546	239	818
1960	33	386	346	1,434	316	79	122
1959	18	381	516	524	95	100	223
1958	107	341	410	675	262	131	427
1957	110	791	398	1,023	458	381	572

(Continued)

TABLE 2

SPRING CHINOOK REDD COUNTS

Year	Upper Salmon River	upper Valley Creek	Upper Yankee Fork	Upper Big Creek	TOTALS	FIVE-YEAR AVERAGE	Herd Creek	N. F. Salmon River
1978	1707	141	60	95	4,669		26	24
1977	698	18	6	9	1,776		6	31
1976	378	NC	40	22	971	2,258	27	6
1975	509	189	60	77	2,244		11	14
1974	338	127	54	28	1,628			
1973	414	125	104	96	3,394			
1972	748	182	115	60	3,019			
1971	619	89	89	32	2,276	2,788		
1970	432	202	67	--	2,793			
1969	313	350	53	90	2,459			
1968	637	330	234	90	4,277			
1967	943	253	250	67	4,654			
1966	699	219	112	127	4,213	4,032		
1965	472	204	77	75	2,472			
1964	706	199	146	51	4,545			
1963	638	141	128	181	4,002			
1962	638	157	60	231	4,437			
1961	813	227	192	382	6,177	4,165		
1960	720	83	43	159	3,721			
1959	502	24	10	96	2,489			
1958	535	75	38	140	3,141	4,248		
1957	1,118	225	47	233	5,356			

Upper dam count,
minus turnoff to Oregon and Washington,
minus harvest,
minus return to hatcheries,
minus attrition to natural and other causes,
equals spawning escapement for wild steelhead

3. IDENTIFICATION OF THE MOST SIGNIFICANT CAUSES OF THESE TRENDS OF DECLINE

FISH PASSAGE

The construction of dams has been the single most important factor in the decline of Idaho's anadromous fish stocks. Dams have blocked access to about 2,300 miles of stream habitat within Idaho which formerly provided spawning and rearing for Anadromous fish. Mallet (1974) details this habitat loss.

The remaining stocks of anadromous fish in Idaho have been burdened with an ever-increasing mortality rate as the number of dams they must pass on the Lower Snake and Columbia Rivers has increased. While dam passage mortalities at the now completed eight mainstem dams affect both juvenile and adult fish, the greatest impact has been on the juvenile fish during their downstream migration.

The dam-related mortalities for juvenile fish consist of direct mortalities from passage through turbines and over spillways, increased susceptibility to predation, nitrogen supersaturation, and migration delays which can prevent the completion of the normal life cycle of the fish. Collins et al. (1975) found that during 1966-74 these cumulative passage mortalities for Idaho's fish ranged from 40 to 95 percent, depending on flow and spill conditions. Junge and Haas (1979) provided an analysis of flow- and turbine-related mortalities and their relationship to current system operations.

The current juvenile collection and transportation facilities at lower Granite and Little Goose Dams on the Lower Snake River become fully operational in 1977. These facilities have been able to collect up to 65 percent of the juvenile fish passing the dams for truck or barge transport to the area below Bonneville Dam. However, in low flow years, such as 1977, as many as 50 percent of the migrating smolts may residualize in Lower Granite Reservoir, never reaching the collection facilities and providing no future adult returns to Idaho (Park et al., 1978). Further suppression of the normal spring runoff by future power and storage operations could result in significant flow-related mortalities at Lower Granite Dam on an annual basis. Under these potential conditions, and without bypass facilities at Lower Monumental and Ice Harbor Dams, even a 97 percent survival rate to the ocean for transported fish would continue to result in a 35 to 70 percent overall mortality rate for Idaho's smolt migration.

LOGGING, MINING AND GRAZING

Logging and mining, along with their associated construction activities, and grazing have had significant impacts on Idaho's anadromous fish populations. The precise impacts on the anadromous fish numbers from these activities has been difficult to quantify as the degradation of spawning and rearing areas has occurred concurrently with increasing dam-related mortalities and varying downriver harvest rates. However, certain stream sections have suffered very obvious and sometimes massive degradation.

Platts (1968a) details the demise of the South Fork of the Salmon River spawning and rearing habitat for summer chinook and steelhead by massive sediment deposition following extensive roading and logging on the fragile

granitic soils. Corley (1967) describes the virtual elimination of chinook salmon and steelhead from Panther Creek (a tributary to the Salmon River) due to lethal levels of copper and acid mine wastes released into the drainage as a result of mining activity (as many as 2,000 adult chinook may have utilized Panther Creek each year prior to mining operations). Dredge mining operations have disrupted and permanently altered important spawning and rearing tributaries such as Bear Valley Creek (a tributary to the Middle Fork of the Salmon River). This and other streams have also been affected by heavy grazing uses (Platts, 1968b). Mallet (1974) lists these detrimental impacts for other streams within the state.

IRRIGATION WITHDRAWLS AND DIVERSIONS

The dewatering of streams used by anadromous fish or loss of juvenile fish down irrigation diversions has been a recurring problem in several Idaho streams. Screening of many diversions in the Salmon River drainage has provided some relief to juvenile losses. However, the reduction of rearing habitat and blockage of adult movement by dewatering is still common in several streams, particularly in the Lemhi drainage (Mallet, 1974).

4. IDENTIFICATION AND DESCRIPTION OF HABITAT AREAS AND/OR PROBLEMS NOW CRITICAL TO THE SURVIVAL OF THESE STOCKS

All stocks of Idaho's anadromous fish share the critical problem of dam passage in the Lower Snake and Columbia Rivers. Other problems to their survival, such as controlling harvest levels and degradation of their spawning and rearing habitats are also shared in varying degrees by most or at least segments of the various fish stocks.

Sockeye

At present, it appears that the major problems affecting the continued survival of Idaho's remaining sockeye salmon are fish passage mortalities at the mainstem dams and the lack of sufficient numbers of truly anadromous adults to provide future increases to the stock even if downstream survival is improved.

Bjornn et al. (1968) found evidence that the post-Sunbeam Dam stock of Redfish Lake sockeye may have recently originated from the kokanee or residual sockeye salmon population in the lake. Therefore, the present stock of Idaho's sockeye may be genetically quite different from the original pre-Sunbeam Dam stocks and not as well suited to and anadromous life cycle.

During their turbine screening experiments at McNary Dam, the NMFS has found that sockeye smolts appear to migrate through the turbine intakes at greater average depths than chinook and steelhead. This could mean that they are less likely to be collected for transport by the type of traveling screens used at Lower Granite and Little Goose Dams.

Fall Chinook

Pages 74-77 of the summary of the endangered species workshop (NMFS, 1979) identify most of the current problems critical to the survival of Snake River fall chinook. Not only has their spawning and rearing habitat been reduced to about one-sixth of its former area by dam construction, but flow fluctuations created by power peaking may be inhibiting their spawning success in the Snake River below Hells Canyon Dam. Commercial harvesting of fall chinook, particularly in the Columbia River, may also be increasing the downward trend of this stock.

Summer Chinook

Summer chinook are still found at reduced levels in several portions of the Salmon River drainage which have suffered spawning and rearing habitat degradation from logging, mining, grazing and irrigation diversion. The South Fork of the Salmon River was formerly the single most important producer of summer chinook in Idaho prior to the massive sedimentation that occurred there beginning in late 1964. This area must be carefully protected to allow its continued recovery and provide for increasing natural and artificial production.

Besides the South Fork of the Salmon River, portions of the Middle Fork, East Fork and Yankee Fork of the Salmon River, the Pahsimeroi River and the Upper Salmon River are key streams for summer chinook survival. All of these streams have suffered in various degrees from logging, mining, grazing or irrigation practices.

Spring Chinook

Several Idaho stream sections which have supported spring chinook spawning and rearing have suffered degradation due to land management practices and mining. However, spring chinook stocks have a much broader distribution within the state than either fall or summer chinook. Significant numbers of spring chinook are artificially propagated and reintroductions into former ranges have been accomplished. Therefore, at present, the critical habitat for spring chinook revolves around sufficient flows and dam bypasses to get them safely to the ocean and back.

Summer Steelhead

Pages 68-70 of the endangered species workshop summary (NMFS, 1979) identify most of the problems facing Idaho's steelhead. Positive transportation benefits

and successful artificial propagation programs will help to keep harvestable steelhead runs in the future. The wild stocks of steelhead, however, are in a very depressed state and are probable being overharvested, particularly in the Zone 6 Indian fishery.

5. QUANTIFICATION OF HARVEST EFFECTS ON THESE STOCKS

Harvest of stocks of the salmonids under review occurs in varying degrees in the ocean sport and commercial fisheries off Alaska, British Columbia, Washington, Oregon and California. It is unlikely that the responsible ocean fisheries management agencies can supply discreet quantative data on harvests of the stocks of concern.

More precise data are available for sport and commercial harvests on the Columbia River (ODFW & WDF, 1978).

Sockeye

Landings reported for the Columbia River are small or nonexistent since 1974 (ODFW & WDF, 1978). Landings of this species in the ocean are probably not significant.

Fall Chinook

Roughly two fish are caught in the ocean for each fish that returns to the Columbia River (NMFS, 1979). Columbia River commercial catches ranged from 45 percent to 63 percent of the upriver run in the 1970's (ODFW & WDF, 1978). Extrapolating the above would indicate that a run of fall chinook entering the Snake River could increase up to sixfold in the absence of ocean and Columbia River harvests.

TABLE 3. Idaho Salmon and Steelhead Catch Estimates, 1954-1978

Year	Chinook Salmon Catch Estimate	Steelhead Trout Catch Estimate
1954	15,000	12,000
1955	19,000	13,000
1956	21,000	8,000
1957	39,000	20,000
1958	24,000	30,000
1959	20,000	31,000
1960	21,000	30,000
1961	13,000	25,000
1962	12,000	19,000
1963	12,000	26,000
1964	8,000	18,000
1965	Season Closed	20,000
1966	8,500	20,000
1967	6,500	22,500
1968	10,000	23,000
1969	11,500	15,500
1970	5,500	20,500
1971	3,500	17,500
1972	6,500	13,500
1973	9,500	10,500
1974	1,500	3,000
1975	Season Closed	Season Closed
1976	Season Closed	2,000
1977	3,500	13,000
1978	7,000	**

**Unavailable

Summer Chinook

Landings from the ocean fisheries have not been well-documented. Columbia River landings are documented in ODFW & WDF (1978). Sport landings in Idaho have contained few summer chinook after 1964 as Idaho's salmon fishing closures and seasons have been aimed at protection of this stock. The Indian harvest within Idaho is undocumented but has the potential for a significant impact on segments of the run.

Spring Chinook

Landings from the ocean fisheries have not been well-documented. Columbia River landings are documented in ODFW & WDF (1978). After 1964, Idaho's salmon sport catch has been comprised almost entirely of spring chinook (Table 3). The Indian harvest within Idaho is undocumented but has the potential for a significant impact on segments of the run.

Summer Steelhead

Ocean catches are thought to be too small for concern. Columbia River catches are reported ODFW & WDF (1978). Unpublished data of the NMFS show that in 1978 the Columbia River Treaty Indian fishery caught 50 percent of the group B steelhead run destined for the Snake River. In this run, an overharvest of the wild fish component certainly occurred.

6. HOW MIGHT HARVESTS BE REGULATED TO PROTECT DEPLETED STOCKS FROM OVERFISHING?

The answer is obvious. Do not fish with non-selective gear at a time or in a place where the depleted stock occurs. On the matter of gear in the Columbia River, legislative action would be required to place gill nets with other, more selective commercial gear. As for time and place of fisheries, we believe the states have the ability to regulate under existing authority.

7. WHAT REMEDIAL ACTIONS ARE PLANNED THAT CAN OFFSET THE TRENDS OF DECLINE, AND WHEN WILL THE ACTIONS BE INITIATED?

Idaho Department of Fish and Game, through the Columbia River Fisheries Council, is attempting to identify, define and institute water management practices in the Columbia River basin which will result in optimum survival conditions for all of Idaho's anadromous fish. These measures include the development of dam collection and bypass facilities, mass transportation where necessary, flow management, and spill management on an interim basis. We are working with the U.S. Forest Service, Bureau of Land Management and private individuals to screen all important irrigation diversions within the Salmon River drainage and to institute land management practices which protect and enhance spawning and rearing areas used by anadromous fish.

Sockeye

No specific remedial actions are presently planned for Idaho's sockeye salmon. They may benefit slightly from mass transport at Lower Granite Dam. However, the original Idaho sockeye tock may no longer be extant. No fishery for sockeye exists in Idaho.

Fall Chinook

Completion of the Lower Snake River mitigation hatchery and further mitigation by Idaho Power Company for Hells Canyon fish May provide the needed replenishment and maintenance of Idaho's fall chinook. If construction began this year and the program went well, little increase in fall chinook would be seen until after 1985. It is not known at this time if the ongoing egg bank program for fall chinook will be successful in preventing the complete loss of the stock before the scheduled hatchery production can commence.

Summer Chinook

Since 1974, we have been running a pilot program with the Corps of Engineers in which about 550 adult summer chinook are trapped at Little Goose Dam. Eggs from these fish are incubated at McCall and Mackay fish hatcheries and the resulting smolts released into the South Fork of the Salmon River. The McCall fish hatchery will be modified and enlarged this year and become a fully developed site for the propagation of one million summer chinook smolts for the South Fork of the Salmon River. A trapping and holding facility for adults is also scheduled for completion this year on the South Fork. The Forest Service is continuing a sediment monitoring program in the South Fork drainage to help protect the habitat from further degradation.

A small artificial propagation program for summer chinook in the Pahsimeroi River was initiated in 1969. The Pahsimeroi station released 508,000 summer chinook in 1978.

Spring Chinook

See pages 71-72 of the workshop summary (NMFS, 1979). Additional hatchery facilities for spring chinook on the Salmon and Clearwater Rivers under the Lower Snake River Compensation Plan are scheduled to begin production in about 1985.

Summer Steelhead

Further artificial production facilities for the Clearwater and Salmon Rivers under the Lower Snake River Compensation Plan are scheduled to be in production around 1985. Mitigation from Idaho Power Company for steelhead runs affected by their dams in the mid-Snake River could also be near full production by then.

8. WHEN AND HOW MUCH WILL THE ACTIONS BE EXPECTED TO OFFSET THE TRENDS?

The success of any program to restore a particular stock of Idaho's anadromous fish is dependent upon many factor, some within and some beyond our control. Local and regional weather patterns will affect fish production and survival in the tributaries and survival during the downstream and upstream migrations. A series of dry years now could be especially damaging to all our stocks. Serious disease outbreaks in our hatcheries and how well and how quickly we solve our dam passage problems will have a significant impact on the restoration of any particular run. Changes in the ocean currents and ocean and river fisheries will also affect anadromous fish production and survival. For these and other reasons it is almost impossible to predict with any certainty the time that the downward or unstable trends may cease.

This year's chinook runs to Idaho could be at an all-time low following the extremely poor downstream migration conditions of 1977. The Clearwater steelhead runs could also be extremely poor in 1979. Given the good downstream passage conditions in 1978 and full implementation of the collection and transportation facilities at Lower Granite and Little Goose Dams, we should find improvement of spring chinook and steelhead runs in 1980. Both of these stocks contain a significant hatchery component. With near-average water supply years and no unusually large hatchery mortalities, spring chinook and steelhead should show continued improvement following the expected 1979 low.

Summer chinook, fall chinook and sockeye have a much more dubious future. None of these stocks have significant hatchery components. The small return

of fall chinook and sockeye expected in 1979 may not be sufficient to provide enough eggs for the continued survival of the stocks. At best, these stocks will continue at mere existence levels for several years even with an all-out effort to save them.

The outlook for summer chinook is not as bleak as for the fall chinook or sockeye, but the small hatchery component of the summer chinook cannot increase their numbers significantly for several years. Nevertheless, their wider spawning distribution and the small hatchery component may prevent them from declining below the expected 1979 run level if the water supply in the Pacific Northwest remains at or above average in the next few years.

* * * * * *

LITERATURE CITED

Bjornn, T.C., D.R. Craddock and D.R. Corley. 1968. Migration and survival of Redfish Lake, Idaho, sockeye salmon, *Oncorhynchus nerka.* Trans. Amer. Fish. Soc., 97 (4) : 360-373.

Collins, G.B., W.J. Ebel, G.E. Monan, H.L. Raymond and G.K. Tanonaka. 1975. The Snake River salmon and steelhead crisis. NOAA, NMFS, Northwest Fisheries Center. Processed Report. 30pp.

Corley, Donald R. 1967. Biological sampling of Panther Creek above and below the introduction of mining wastes, 1967. Id. Dept. Fish and Game. 18pp.

Evermann, B.W. 1895. A preliminary report upon salmon investigations in Idaho in 1984. Bull. U.S. Fish. Comm. 15;253-284

Graban, J.R. 1964. Evaluation of fish facilities at Brownlee and Oxbow Dams. Id. Dept. Fish and Game. Vol. 13, No. 167. 65pp.

Haas, J.B. and C.O. Junge. 1979. Rationale for Instream flows for fisheries in the Columbia and Snake Rivers. Columbia River Fisheries Council. 24pp.

Hoss, Steven L. 1978. Annual project closing report--Clearwater River development of spring chinook and steelhead stocks. Id. Dept. Fish and Game. Mimeo. 8pp.

Idaho Department of Fish and Game. 1978. A plan for the future management of Idaho's fish and wildlife resources, Volume I: goals, objectives and policies, 1975-1990. Id. Dept. Fish and Game. 170 pp.

Mallet, Jerry. 1974. Inventory of salmon and steelhead resources, habitat, use and demands. Id. Dept. Fish and Game. 212 pp.

National Marine Fisheries Service. 1979. Summary of workshop, biological basis for listing species or other taxa of salmonids pursuant to the Endangered Species Act of 1973. NOAA, NMFS, Northwest Regional Office. 97pp.

Oregon Department of Fish and Wildlife and Washington Department of Fisheries. 1978. Columbia River fish runs and fisheries, 1957-1977. ODFW & WDF. 69pp

Ortmann, David W. 1978. Annual survey of the salmon and steelhead sport fishery harvest in Idaho. Id. Dept. Fish and Game, Project F-18-R-24. 30pp

Pacific Northwest Regional Commission. 1976. Columbia Basin salmon and steelhead analysis. PNRC. 74pp.

Park, D.L., J.R. Smith, E.Slatick, G.M. Matthews, L.R. Basham and G.A. Swan. 1978. Evaluation of fish protective facilities at Little Goose and Lower Granite Dams and review of mass transportation activities, 1977. 60pp.

Prittle, Ralph B.1956. The size and timing of runs of adult spring chinook salmon in the Columbia and Snake Rivers and their tributaries above the confluence of the Snake River, 1955. Annual report for the U.S. Army Corps of Engineers. Contract DA 35-026-eng-20608. 77pp.

Platts, William S. 19689a. South Fork Salmon River, Idaho, aquatic habitat survey with evaluation of sediment accruement, movement and damages. USDA, Forest Service--Boise National Forest. 135pp.

Platts, William S. 1968b. Bear Valley Creek preliminary aquatic habitat survey. USDA, Forest Service. 31pp.

Richards, Monte R. 1960. Lower Salmon River drainage chinook spawning ground survey, 1960. Id. Dept. Fish and Game, Vol. 7, No. 103. 36pp.

U.S. Army Corps of Engineers, North Pacific Division. Annual Series 1939-78. Annual fish passage report. North Pacific Division, Corps of Engineers, Portland and Walla Walla Engineer Districts.

Welsh, Thomas L., Steven A. Hoss and Kent W. Ball. 1978. Salmon spawning ground surveys. Id. Dept. Fish and Game. 37pp.

Zimmer, Paul D. 1950. A three-year study of fall chinook salmon spawning areas in Snake River above Hells Canyon Dam site. U.S. Fish and Wildlife Service, Region I. 23pp.